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PROGRESS REPORT

Grant # N00014-89-J-3246

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GRANT TITLE: Mechanism by which cold shock evokes exocytosis of symbiotic algae in marine cnidarians.

REPORTING PERIOD: 30 September 1989 - 30 May 1993

AWARD PERIOD: 30 September 1989 - 30 May 1993

OBJECTIVES:

1. To determine the mechanism by which low temperature evokes release of symbiotic algae from marine cnidarians (sea anemones and corals).

2. To identify host factor in symbiotic cnidarians.

APPROACH:

OBJECTIVE 1: Marine cnidarians were subjected to cold shock, heat shock, and UV irradiation, and the mode of release of zooxanthellae was investigated. It was determined that all three types of acute stress evoked detachment and expulsion of intact host endoderm cells containing zooxanthellae. To determine how cold shock evokes cell detachment we have formulated the hypothesis that temperature stress evokes membrane phase changes which permit passive influx of calcium ions into host cells. The elevated calcium leads to collapse of elements of the host skeleton, and concomitant cell adhesion dysfunction. Hypothesis testing has included application of electron spin resonance, calcium pharmacology, use of calcium-specific fluorochromes, and image analysis.

OBJECTIVE 2: Gel filtration and HPLC, in conjunction with an *in vitro* glycerol release bioassay, were used to identify host factor activity in the reef coral *Pocillopora damicornis*. Host factor *in vitro* was identified as a set of free amino acids. Host factor activity of FAA's (% release of fixed carbon; selective release of glycerol and other metabolites) was virtually identical to that elicited by crude extracts of host tissue. We are now attempting to devise bioassays for discerning signal molecule activity *in hospite*.

ACCOMPLISHMENTS:

PUBLICATIONS

Muscatine, L. D. Grossman, and J. Doino (1991) Release of symbiotic algae by tropical sea anemones and corals after cold shock. Mar. Ecol. Prog. Ser. 77:233-243.

Gates, R., G. Baghdasarian, and L. Muscatine (1992) Temperature stress causes host cell detachment in symbiotic cnidarians: Implications for coral bleaching. Biol. Bull. 182: 324-332.

Gates, R. and L. Muscatine (1992) Three methods for isolating viable anthozoan endoderm cells with their intracellular symbiotic dinoflagellates. Coral Reefs 11:143-154.

Bil', K., P. Kolmakov. and L. Muscatine (1992) Photosynthetic products of zooxanthellae of the reef building corals Stylophora pistillata and Seriatopora coliendrum. Atoll Res. Bull. No. 377, pp. 1-8.

Berner, T., G. Baghdasarian, and L. Muscatine (1993) Repopulation of a sea anemone with symbiotic dinoflagellates: analysis by in vivo fluorescence. J. Exp. Mar. Biol. Ecol. (In Press)

IN PREPARATION

Gates, R., O. Hoegh-Guldberg, M. McFall-Ngai, and L. Muscatine (1993) Cnidarian host factor: Free amino acids evoke release of photosynthate and increase photosynthetic rate in zooxanthellae in vitro.

Nii, C. and L. Muscatine (1993) Oxidative stress in symbiotic cnidarians is an animal phenomenon.

Doino, J.A. (1993) Low temperature acclimation in the subtropical sea anemone Aiptasia pulchella. M.S. Thesis, University of California at Los Angeles, 68 pp. + Tables and Figures.

RELATED PUBLICATIONS FROM OUR LABORATORY

Weis, V. M. (1990) The induction of carbonic anhydrase activity in the symbiotic sea anemone Aiptasia pulchella. Biol. Bull. 180:

Muscatine, L. and V. M. Weis (1992) Productivity of zooxanthellae and biogeochemical cycles. pp. 257-271 In Primary Productivity and Biogeochemical Cycles in the Sea, (Eds.) P.G. Falkowski and A. Woodhead, Plenum Press, New York.

Muscatine, L. (1990) The role of symbiotic algae in carbon and energy flux in reef corals. Ch. 4 In Coral Reefs, (Ed.) Z. Dubinsky, Elsevier, Amsterdam.

Muscatine, L. and I. R. Kaplan (1993) Resource partitioning by reef corals as determined from stable isotope composition. II. $\delta^{15}N$ of zooxanthellae and animal tissue vs. depth. Pac. Sci. (In press).